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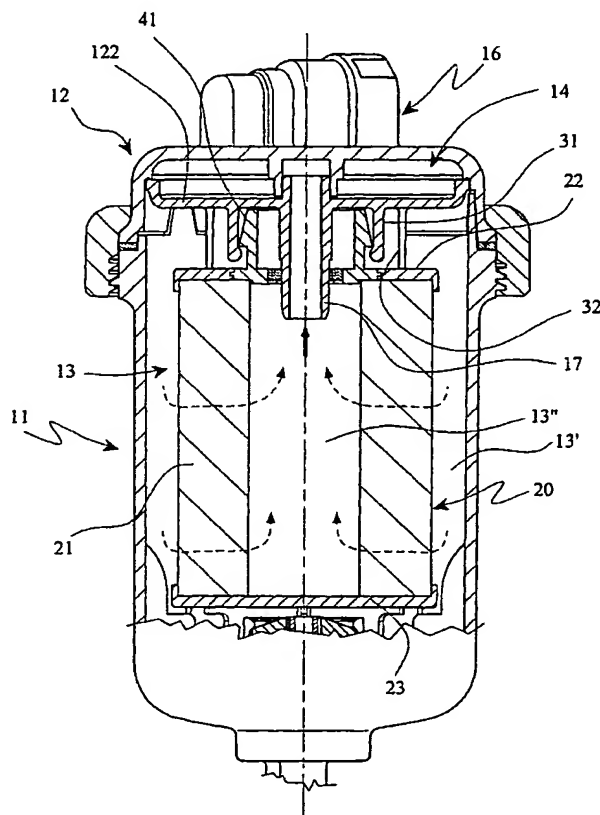
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(54) Title: **LIQUID FILTER FOR VEHICLE INTERNAL COMBUSTION ENGINES**



(57) Abstract: The filter comprises an outer casing (11), an upper closure cover (12), and a filter cartridge (20) having a tubular filter medium (21) positioned inside the inner chamber (13), to separate the filter inner chamber (13) into a first region communicating with the inlet and a second region communicating with the outlet, and an upper disc (22) joined to the upper end of the filter medium (21). First coupling elements (31) joined to the cover (12) and projecting axially towards the interior of the chamber (13), and second coupling elements (41) joined to the upper disc (22) and projecting axially towards the upper cover (12), are provided to act together to achieve mutual snap-coupling. The first coupling elements (31) comprise axially extending coupling teeth with elastic action in a radial direction, and the second coupling elements (41) comprise a generally cylindrical surface divided into a number of identical sectors equal to the number of coupling teeth (31), each sector comprising a coupling region (43) for snap-engaging the coupling teeth (31) axially, and a disengagement region (44), positioned to the side of the coupling region (43), for releasing the coupling teeth (31) from their engagement with the coupling region (43) by rotating the cartridge (20) through a small angle relative to the upper cover (12).



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DESCRIPTION

LIQUID FILTER FOR VEHICLE INTERNAL COMBUSTION ENGINES

TECHNICAL FIELD

- 5 This invention relates to a liquid filter for vehicle internal combustion engines, in particular for oil or diesel fuel.

BACKGROUND ART

For some years filters have been constructed having an outer casing and
10 an upper closure cover, which enclose an inner chamber having an inlet for the liquid to be filtered and an outlet for the filtered liquid, and a filter cartridge having a tubular filter medium positioned inside the inner chamber to separate the chamber into a first region communicating with the inlet and a second region communicating with the outlet.

- 15 The filter cartridge is secured to the upper cover by an upper disc joined to the upper end of the filter medium and which, when consumed and needing replacement, is separated from the cover and replaced with a new cartridge.

Said filters are currently appreciated because the entire filter does not
20 have to be scrapped and destroyed, but merely the spent filter cartridge. Accessibility to the cartridge is also facilitated in that, as this is secured to the closure cover of the casing, on opening the cover the cartridge follows it to emerge from the liquid in which it is immersed without having to be gripped with tools and without having to be shaken out or disengaged,
25 which could cause damaging dirt to separate from it.

To secure the cartridge to the cover it is known (see US 5695633 in particular) to use first coupling elements and second coupling elements which act together to achieve a mutual snap connection, the first coupling elements (or the second coupling elements) being joined to the cover and
5 projecting axially towards the chamber interior and, vice versa, the second coupling elements (or the first coupling elements) being joined to the upper disc and projecting axially towards the upper cover.

A drawback of these filters is that, while there are no difficulties in coupling the cover and filter cartridge together, a considerable axial force is
10 however required to separate these elements when a spent cartridge has to be replaced with a new one. If carried out manually, this separation operation, in addition requiring considerable force, can also, because of the fact that the spent cartridge is impregnated with oily impurities and miscellaneous dirt, cause these impurities and dirt to spatter all around,
15 with the risk of soiling the operator and also the inner chamber of the filter. An object of this invention is therefore to provide a filter of the
aforescribed type, in which the filter cartridge can be rapidly coupled to the casing cover and be easily and delicately released therefrom.

20 DISCLOSURE OF THE INVENTION

This and further objects are attained by the invention as characterised in the claims.

The invention is based on the fact of comprising first coupling elements having axially extending coupling teeth with elastic action in a radial
25 direction, and second coupling elements having an overall cylindrical surface divided into a number of identical sectors equal to the number of

coupling teeth, each sector comprising a coupling region for snap-engaging the coupling teeth axially, and a disengagement region, positioned to the side of the coupling region, for releasing the coupling teeth from their engagement with the coupling region by rotating the
5 cartridge through a small angle relative to the upper cover.

The invention is described in detail hereinafter with the aid of the accompanying figures which show one embodiment thereof by way of non-exclusive example.

Figure 1 is an overall axial section through the entire filter.

10 Figure 1A is an enlarged detail of Figure 1.

Figure 2 is a plan view from below of just the central element of the upper cover of Figure 1.

Figure 3 is a perspective view of just the upper disc for the cartridge of Figure 1.

15 Figure 4A is a plan view from above of the disc of Figure 3.

Figure 4B is a side view in the direction of the arrow B of Figure 4A.

Figure 4C is another side view in the direction of the arrow C of Figure 4A.

Figure 4D is a section on the plane D-D of Figure 4B.

The Figure of the invention comprises an upperly open outer casing 11, in particular of roughly cylindrical shape, having an upper closure cover 12,
20 and enclosing a roughly cylindrical inner chamber 13.

The chamber 13 possesses an inlet (not shown in the figures) for the liquid to be filtered which, in the embodiment shown in the figures, is positioned laterally on the cylindrical surface of the casing 11, and an outlet for the
25 filtered liquid which, in the embodiment shown in the figures, is positioned on the upper cover 12.

In the interior of the chamber 13 there is positioned a filter cartridge 20 having a tubular filter medium 21 positioned inside the inner chamber 13, which separates the chamber into a first region 13' communicating with the inlet and a second region 13" communicating with the outlet 16.

5 The cartridge 20 also comprises an upper disc 22, in the form of a circular plate, which entirely and exactly covers the flat annular upper surface of the filter medium 21 and is rigidly joined to it. The cartridge 20 finally comprises a lower disc 23, in the form of a circular plate, which entirely and exactly covers the flat annular lower surface of the filter medium 21
10 and is rigidly joined to it.

In the embodiment shown in the figures, the cover 12 possesses a substantially flat chamber 14 defined between the upper inner surface 12a of the cover and, spaced from the surface 12a, a lower circular wall 122 joined rigidly to and forming part of the cover 12. Said chamber 14
15 communicates with the outlet 16 and with the region 13" in the interior of the filter medium 21 by an axial tube 17 which passes through an aperture provided in the centre of the upper disc 22. A gasket 221 forms a hermetic seal between the disc 22 and the tube 17.

The filter also possesses first coupling elements and second coupling
20 elements acting together to form a mutual snap engagement. In the embodiment shown in the figures, the first coupling elements are joined to the cover 12 (in particular they are integral with the wall 122) and project axially downwards, towards the interior of the chamber 13, whereas the second coupling elements 40 are integral with the upper disc 22 and
25 project axially upwards, towards the upper cover 12. In an alternative embodiment (not shown in the figures) the second coupling elements

projecting axially downwards towards the interior of the chamber 13 are joined to the cover 12, and vice versa the first coupling elements are joined to the upper disc 22 and project axially upwards towards the upper cover 12.

- 5 According to the invention, said first coupling elements comprise two or more axially extending coupling teeth 31 with elastic action in the radial direction, whereas said second coupling elements comprise a tubular body 41 having an overall cylindrical outer surface divided into a number of identical sectors equal to the number of coupling teeth 31.
- 10 Each sector of the cylindrical surface defines a coupling region 43 for axially snap-engaging the coupling teeth 31, and a disengagement region 44, positioned to the side of the coupling region, for releasing the coupling teeth 31 from their engagement with the coupling region 43 by rotating the cartridge 20 relative to the upper cover 12 through a small angle.
- 15 Specifically, each said coupling region 43 defines, in cross-section, a second coupling tooth complementary to the first coupling teeth 31 and arranged to snap-receive the first coupling teeth 31 by mutual approach in an axial direction, and engage them. In detail (see Figures 4A-4C specifically), the coupling region 43 possesses a slightly inclined upper
- 20 portion 43a, the radius of which increases downwards, followed by a lower groove 43b which forms a sharp edge 43d in the form of a saw tooth, to engage a first coupling tooth 31.

The disengagement region 44 comprises a smooth cylindrical surface portion 44a extending over the entire height, and an arc-shaped surface

25 strip 44b forming a connection ramp which continuously degrades along the circumference from the groove 43b to the surface portion 44a, to

transfer the coupling teeth from said groove 43b to the smooth cylindrical surface 44a.

On the other side of the coupling region 43 there is a rectilinear rib 45, which separates the coupling region 43 of one sector from the coupling
5 region 44 of the other sector, and projects radially outwards from the surrounding regions 43 and 44.

The cover 12 also comprises downwardly projecting abutment elements which abut with their lower end against the upper surface of the upper disc 22 when the coupling elements are mutually engaged. In particular, said
10 elements 32 consist of identical tube segments positioned on the same coaxial cylindrical surface external to the coupling teeth 31.

When the coupling teeth 31 engage the respective sharp edges 43d, the elements 32 abut against the upper surface of the disc 22; by virtue of this abutment, the disc 22 is maintained at an exact axial distance from the
15 cover 12 and in addition the connection between said coupling elements is made free of any slack, as the edges 43d and the edges of the coupling teeth 31 are maintained urged against each other.

When in use, to couple the cartridge 20 to the cover 12, the cartridge is brought towards the cover 12 in an axial direction so that the coupling
20 regions 43 pass between the coupling teeth 31; mutual coupling is achieved by snap-inserting the projections of the teeth 31 into the grooves 43b. The two coupling regions 43 act, together with the guide action produced by the ribs 45, as lead-in tracks to allow reliable insertion by pressing without excessive force.

Rotating the cartridge about its axis during pressing enables these lead-in tracks to be reliably encountered. Coupling is confirmed, and audibly sensed, by the abrupt entry of the teeth 32 into the grooves 43b.

The cartridge 20 can no longer be moved from this stable position except
5 by exerting on it the correct release movement. In this respect, the sharp edge 43d prevents any release of the cartridge 20 by the effect of the forces generated by the pressure changes within the complete filter unit.

The cartridge 20 is released by a two-stage movement; in the first stage the cartridge 20 is rotated (a relatively small torque is sufficient) through a
10 small angle to cause the edges of the teeth 31 to slide along the respective connection ramps 44B (with consequent forcing-apart of the teeth 31) until these edges lie on the smooth surface portions 44a. At this point, by axially pulling the cartridge 20 away from the cover 12, the teeth 31 are separated from the tubular body 41 and the cartridge is released.

15 In this manner the filter medium 21 can be separated from the body of the filter without exerting force at the moment of its release, so preventing liquid escaping and spattering outwards.

Numerous modifications of a practical and applicational nature can be made to the invention, but without leaving the scope of the inventive idea
20 as claimed below.

CLAIMS

1. A filter for vehicle internal combustion engines, comprising an outer casing (11) and an upper closure cover (12) which enclose an inner chamber (13) having an inlet for the liquid to be filtered and an outlet for the filtered liquid, a filter cartridge (20) having a tubular filter medium (21) positioned inside the inner chamber (13), to separate the filter inner chamber (13) into a first region communicating with the inlet and a second region communicating with the outlet, and an upper disc (22) joined to the upper end of the filter medium (21),
- first coupling elements (31) and second coupling elements (41) acting together to achieve mutual snap-coupling, the first coupling elements (31) or the second coupling elements (41) being joined to the cover (12) and projecting axially towards the interior of the chamber (13) and, vice versa, the second coupling elements (41) or the first coupling elements (31) being joined to the upper disc (22) and projecting axially towards the upper cover (12),
- characterised in that said first coupling elements (31) comprise axially extending coupling teeth with elastic action in a radial direction, said second coupling elements (41) comprising an overall cylindrical surface divided into a number of identical sectors equal to the number of coupling teeth (31), each sector comprising a coupling region (43) for snap-engaging the coupling teeth (31) axially, and a disengagement region (44), positioned to the side of the coupling region (43), for releasing the coupling teeth (31) from their engagement with the coupling region (43) by rotating the cartridge (20) through a small angle relative to the upper cover (12).

2. A filter as claimed in claim 1, characterised in that each said coupling region (43) defines a second coupling tooth complementary to the first coupling teeth (31) and arranged to snap-receive the first coupling teeth (31) by mutual approach in an axial direction, and engage them.

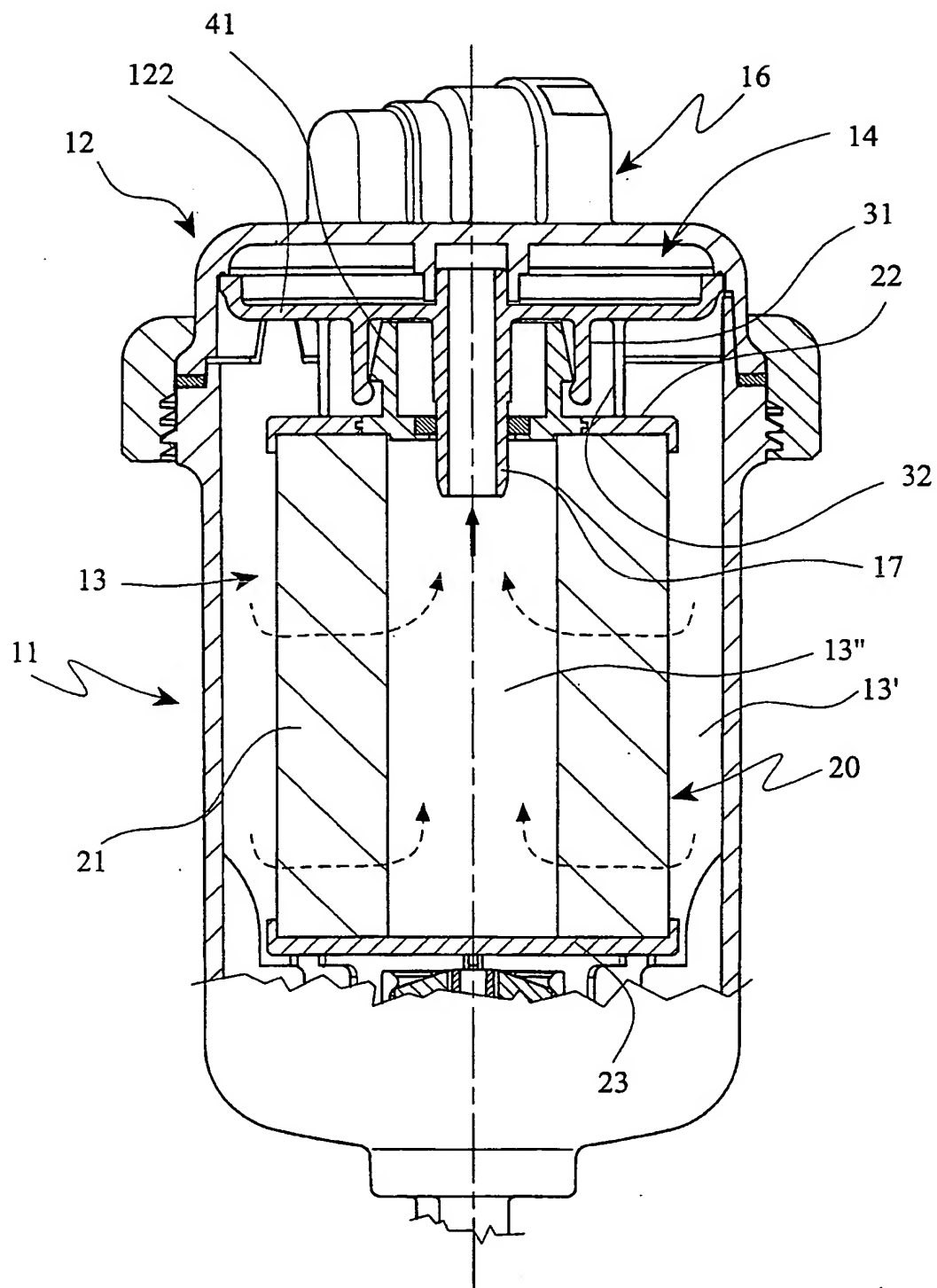
5 3. A filter as claimed in claim 2, characterised in that said disengagement region (44) comprises a smooth cylindrical surface portion (44a) extending over the entire height, and an arc-shaped surface strip (44b) forming a connection ramp arranged to transfer the coupling teeth (31) from a toothed groove (43b) to the smooth cylindrical surface portion
10 (44a).

4. A filter as claimed in claim 1, characterised by comprising axial abutment elements (32) projecting from the upper cover (12) and arranged to abut against the upper surface of the upper disc (22) when said coupling elements (31 and 41) are mutually engaged, to exactly define the
15 distance between the cover (12) and the disc (22) and render the connection between said coupling elements (31, 42) free of slack.

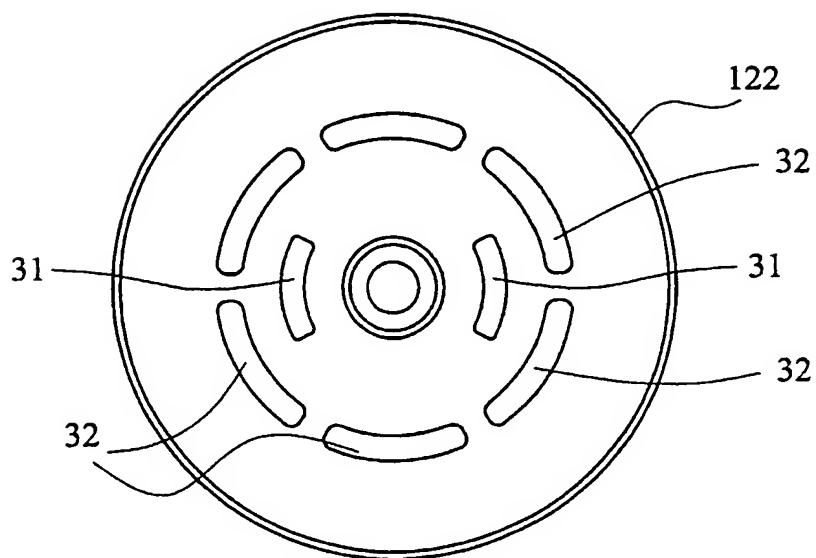
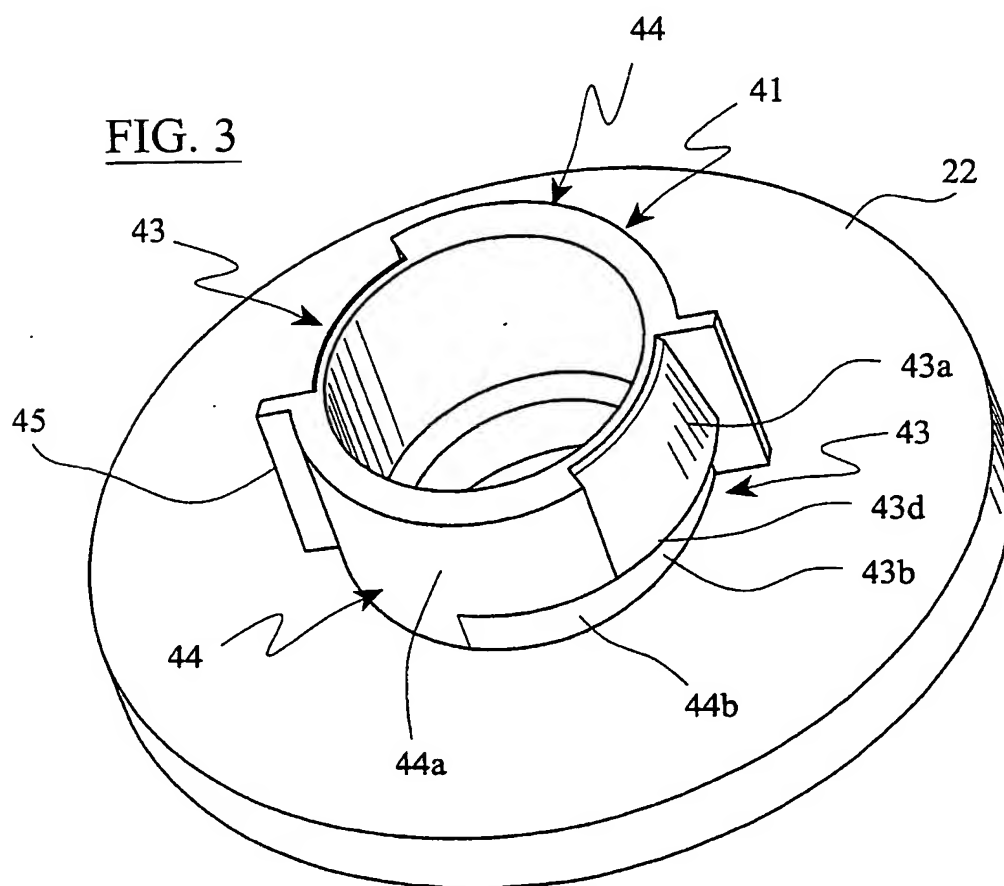
5. A filter as claimed in claim 1, characterised by comprising axial abutment elements (32) projecting from the upper disc (22) and arranged to abut against the lower surface of the upper cover (12) when said
20 coupling elements (31 and 41) are mutually engaged, to exactly define the distance between the cover (12) and the disc (22) and render the connection between said coupling elements (31, 42) free of slack.

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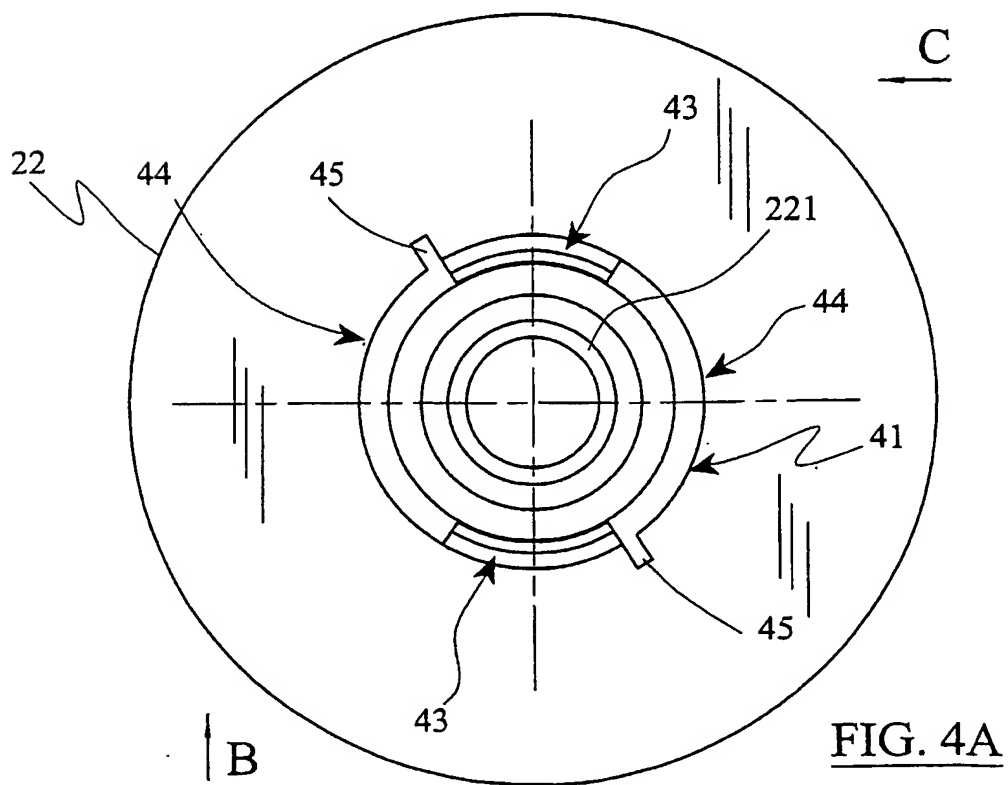
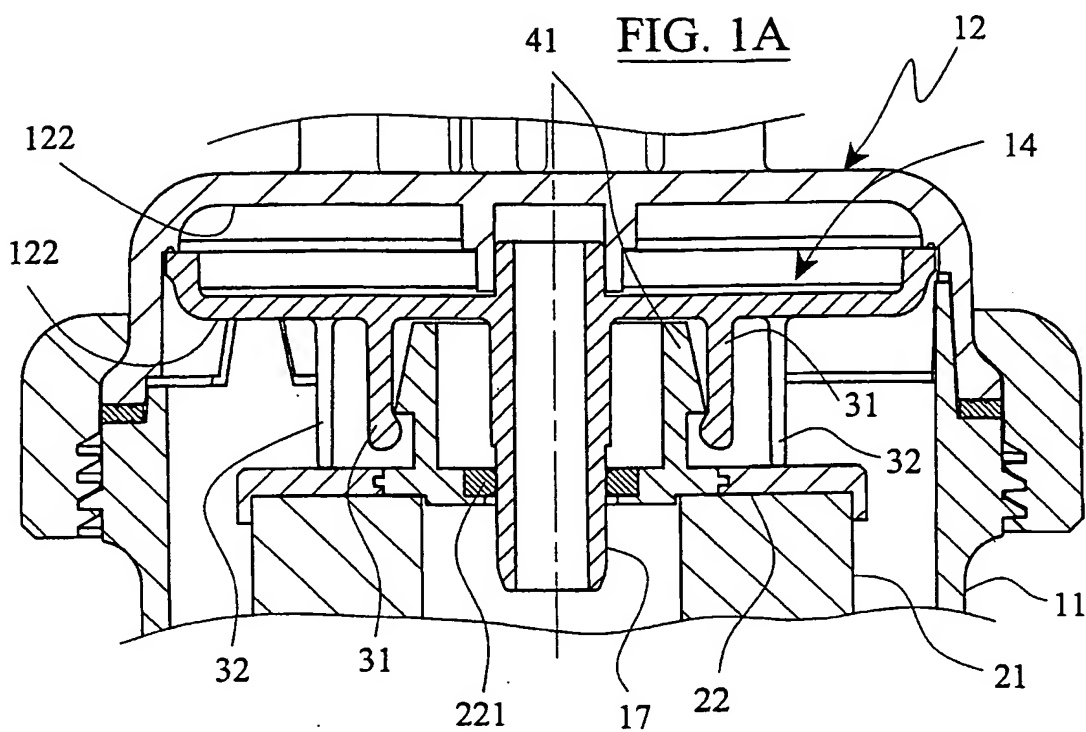
FIG. 1



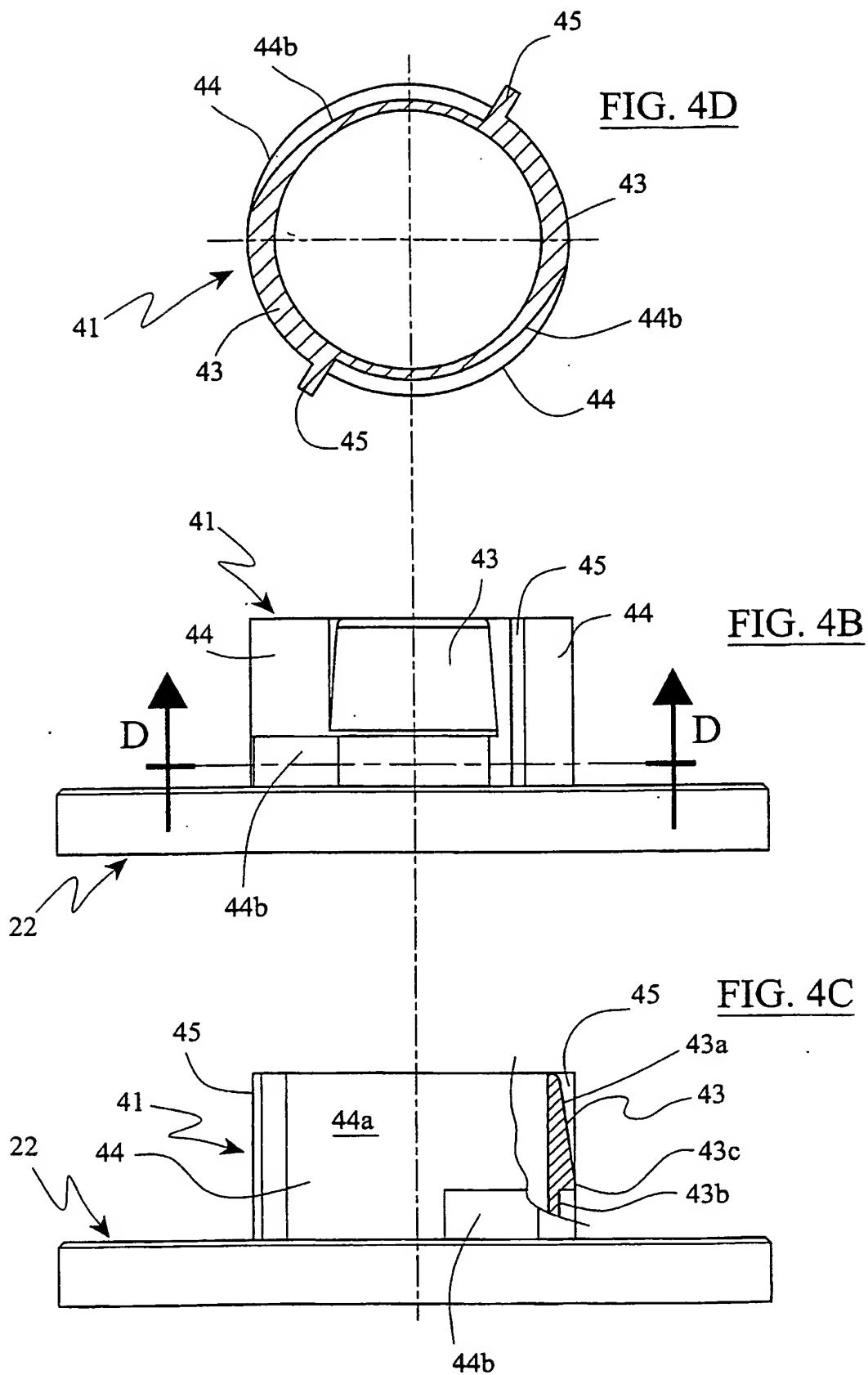
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FIG. 2FIG. 3

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A. CLASSIFICATION OF SUBJECT MATTER

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IPC 7 B01D29/21 B01D35/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

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